

Numerical Tool and Process Control Programmers

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What They Do

Many of the functions in machining that were formerly performed by human operators are now more precisely performed by a computer-controlled module. This is true for machines such as lathes, multiaxis spindles, milling machines, and electrical discharge machines.

Before Numerical Tool and Process Control Programmers machine a part, they must carefully plan, prepare, and write computer programs for the operation. First, they review three-dimensional computer aided/automated design (CAD) blueprints of the part. Next, they calculate where to cut or bore into the workpiece, how fast to feed the metal into the machine, and how much metal to remove. They then select tools and materials for the job and plan the sequence of cutting and finishing operations. Finally, they turn the planned machining operations in to a set of instructions or program for the machine to follow.

Numerical Tool and Process Control Programmers work on desktop computers in offices that typically are near, but separate from, the shop floor.

Tasks

- ▶ Prepare geometric layout from graphic displays, using computer-assisted drafting software or drafting instruments and graph paper.
- ▶ Analyze drawings, specifications, printed circuit board pattern film, and design data to calculate dimensions, tool selection, machine speeds, and feed rates.
- ▶ Determine reference points, machine cutting paths, or hole locations, and computes angular and linear dimensions, radii, and curvatures.
- ▶ Write instruction sheets, cutter lists, and machine instruction programs to guide setup and encode numerical control tape.
- ▶ Draw machine tool paths on pattern film, using colored markers and following guidelines for tool speed and efficiency.
- ▶ Enter computer commands to store or retrieve parts patterns, graphic displays, or programs to transfer data to other media.
- ▶ Move reference table to align pattern film over circuit board holes with reference marks on enlarger scope.

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- ▶ Align and secure pattern film on reference table of optical programmer and observe enlarger scope view of printed circuit board.
- ▶ Compare encoded tape or computer printout with original program sheet to verify accuracy of instructions.
- ▶ Revise numerical control machine tape programs to eliminate instruction errors and omissions.

Detailed descriptions of this occupation may be found in the Occupational Information Network (O*NET) at online.onetcenter.org.

Important Skills, Knowledge and Abilities

- ▶ Computers and Electronics — Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- ▶ Mathematics — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- ▶ Operations Analysis — Analyzing needs and product requirements to create a design.
- ▶ Programming — Writing computer programs for various purposes.
- ▶ Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- ▶ Technology Design — Generating or adapting equipment and technology to serve user needs.
- ▶ Complex Problem Solving — Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
- ▶ Critical Thinking — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.
- ▶ Equipment Selection — Determining the kind of tools and equipment needed to do a job.
- ▶ Operation and Control — Controlling operations of equipment or systems.
- ▶ Troubleshooting — Determining causes of operating errors and deciding what to do about them.
- ▶ Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- ▶ Written Comprehension — The ability to read and understand information and ideas presented in writing.
- ▶ Near Vision — The ability to see details at close range (within a few feet of the observer).

Work Environment

Numerical Tool and process Control Programmers work on desktop computers in offices that typically are near, but separate from, the shop floor. These work areas usually are clean, well lit, and free of machine noise. Numerical Tool and Process Control Programmers occasionally need to enter the shop floor to monitor numerically-controlled machining operations. On the shop floor, Programmers encounter the same hazards and exercise the same safety precautions as do the operators. Most Computer Numerical Controlled (CNC) and Process Control Programmers work a 40-hour week; however, overtime is common during peak production periods.

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California's Job Outlook and Wages

The California outlook and wage below represent the occupation across all industries.

Standard Occupational Classification	Estimated Number of Workers 2004	Estimated Number of Workers 2014	Average Annual Openings	2006 Wage Range (per hour)
Numerical Tool and Process Control Programmers				
51-4012	2,000	2,100	40	\$20.29 to \$32.49

Wages do not include self-employment.

Average annual openings include new jobs plus net replacements.

Source: www.labormarketinfo.edd.ca.gov, Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.

Trends

As the programming of tools becomes easier, it may eventually be included in machinists' tasks. This could have an adverse effect on the numbers of Numerical Tool and Process Control Programmers required by employers. In California, the occupation is growing slower than average for all occupations; most of the hiring activity expected between 2004 and 2014 will be the replacement of workers who have left for retirement or other types of work. Some growth is expected in the semiconductor component industry, as well as forging and stamping firms.

Training/Requirements/Apprenticeships

Numerical Tool and Process Control Programmers usually follow one of the following training paths:

- ▶ Formal, four-year apprenticeship
- ▶ Community college programs or certificates
- ▶ Vocational school
- ▶ Extensive on-the-job training

Information about CNC Tool Programmer apprenticeships may be found at www.dir.ca.gov, the Department of Industrial Relations' Web site, which maintains an apprenticeship database for California programs. Apprenticeships require a high school diploma or GED. A growing number of Numerical Tool and Process Control Programmers receive most of their formal training from community or technical colleges.

Some community colleges offer tool design technology courses in their Machine Tool Technology programs. Programs accredited by the National Institute for Metalworking Skills (NIMS) are listed at their Web site (www.nims-skills.org).

Recommended High School Course Work

High school students interested in this kind of work should take mathematics, especially trigonometry, as well as metal shop courses.

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Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at www.labormarketinfo.edd.ca.gov to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- ▶ Aircraft Engine and Engine Parts
- ▶ Aircraft Manufacturing
- ▶ Bolts, Nuts, Screws, Rivets, and Washers
- ▶ Guided Missiles and Space Vehicles
- ▶ Machine Shops
- ▶ Other Aircraft Parts and Equipment
- ▶ Precision Turned Products Manufacturing

Search these **yellow page** headings for listings of private firms:

- ▶ CAD Systems
- ▶ Machine Tools
- ▶ Tools
- ▶ Tool Designers

Where Can the Job Lead?

Experienced Numerical Tool and Process Control Programmers can advance to Tool Designers or management positions. A few open their own shops.

Other Sources of Information

Precision Machined Products Association
www.pmpa.org

National Tooling & Machining Association
www.ntma.org

Precision Metalforming Association Educational Foundation
www.pmaef.org

National Institute for Metalworking Skills
www.nims-skills.org